Key points

- Traditional methods provide good control at half the cost of pesticides.
- Natural enemies can provide high levels of pest control in fruit orchards as long as pesticide use is minimised.
- New entrants into high value horticulture need support to implement sustainable pest management.
- Worker exposure to pesticides can be high in orchard spraying.

After citrus farmers in the Mekong Delta learned about mites, pesticide use increased against these 'newly observed' pests. Training through extension seminars or mass media has often led to such situations: It is not the farmer but the extension officer, scientist or media who is the decision-maker.

- **Creating local consumers' awareness** Stimulating consumers' awareness about the environmental and health risks of pesticides could create a demand for pesticide-free produce, and can encourage direct links between consumer groups and IPM or organic farmer groups. In Vietnam, marketing structures promoting 'green produce' could benefit from stronger collaboration between fruit farmers.
- **Influencing agricultural policy** The government has a very important role to play in promoting the development and dissemination of ecological crop management practices. Participatory training and research in Vietnam is being implemented in rice and vegetables as a successful approach to make farmers better informed decision-makers, and to reduce reliance on chemical inputs while maintaining or improving crop yields.

Conclusions and recommendations

- Farmer participatory training and research in rice and vegetables has shown that pesticide use can be drastically reduced without lowering yield.This approach offers great potential for application in citrus, mango and other fruit cropping systems.
- Farmers'perceptions and experience in fruit cultivation are important inputs for problem definition and for developing farmer participatory training and research curricula.

Resources

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PESTICIDE ACTION NETWORK *UK*

Sustainable fruit production, PMN Nº 11, August 2001.This briefing is one of a series prepared by Pesticide Action Network UK(PANUK), which is responsible for its contents, as consultants to DG Development of the EC. PAN UK is an independent charity working to reduce pesticide problems in developing countries. Its quarterly journal Pesticides News reports on pesticides and IPM.

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PEST MANAGEMENT NOTES *No.11*

Sustainable fruit production

A briefing for the IPM in Developing Countries Project funded by the European Commission (Environment in Developing Countries budget).

This briefing provides a case study of smallholder fruit growers in Vietnam, and the danger of losing traditional practices that keep pest pressures low and reduce pesticide inputs.

The importance of fruit in Vietnam

Fruit production is becoming increasingly important in Vietnam, major perennial fruits being citrus, mango, litchi and longan.The fruit growing area has nearly doubled over the past 10 years with about 394,000 ha being cultivated in 1998, and policy planners expect one million ha for the next decade. Conversion of paddy fields into orchards has not been actively promoted. However the higher net profits from orchards are five to 10 times more than could be achieved on the same area under rice production and this, together with an increased security of land tenure, has attracted many farmers to invest in orchards. Nearly all fruit is produced for the local market, but the government is stimulating intensification of orchards to increase export.

Total fruit production and export could be increased by raising the quality and efficiency of production. Improved fruit quality implies that pesticide residues are kept below the permitted maximum residue limit (MRL) which may currently be exceeded, considering the increasing amount of pesticides used in orchards. High residues are a risk to consumers, and may risk rejection if exported to industrialised countries, which operate strict inspection procedures. This briefing is based on extensive field research and information retrieval in Vietnam over a three-year period.

Strengthening farmers' knowledge base of their agroecosystem. Photo: Paul Van Mele

High chemical inputs

Evolution

Farmers who have been in the fruit growing business for a long time reported that in the 1980s hardly any pesticides were applied in fruit crops. Unfortunately in Vietnam no statistics exist for fertiliser and pesticide use within the different commodity crops. It is generally recognised that the use of agrochemicals has greatly increased in fruit crops due to the changed national agricultural policy in the late 1980s towards an open-market economy, and the aggressive advertising and marketing techniques of the agribusiness companies.

Between 1991 and 1998 the value of pesticide active ingredients imported in Vietnam increased by 600%, accounting for US$120 million. Newcomer fruit farmers have no experience in crop management.They aim at high and fast economic returns and hence all of them calendar spray and use excessive amounts of chemical fertilisers to boost yield.These days, in the intensive mandarin, mango and longan monocropping systems in the Mekong Delta of Vietnam, farmers generally apply more than 10 fungicide and insecticide sprays per year, with some of them reporting up to 40 sprays per year.

Pesticide operator hazards

Organophosphates which are extremely highly toxic to humans (WHO Class 1a and 1b) such as methyl parathion, monocrotophos and methidathion are still frequently used in fruit production. Pesticide operators in orchards are more exposed to pesticides compared to those spraying annual crops. To spray tall trees such as mango and durian, the lance of the pesticide sprayer is connected

Weaver ant nest in soursop tree. Photo: Paul Van Mele

to the tank by a long hose. One person climbs the trees to spray, while a second person stays on the ground and pumps the sprayer to provide the pressure. Richer farmers with a relatively large orchard (greater than 1 ha), often hire labour to spray their trees. The labourers are usually farmers with small orchards (less than 0.3 ha), or rice farmers during times that they are not occupied in their own paddy fields.

Impact on non-target organisms

Before the 1990s pests in Vietnamese orchards were mainly kept under control by a multitude of locally occurring natural enemies, including predators and parasitoids (small wasps that lay their eggs on or in a particular pest).The weaver ant *Oecophylla smaragdina*, which is endemic to Southeast Asia and makes its nests in the trees by weaving several leaves together, has long been an important predator, keeping most citrus and mango pests in check. In some preliminary experiments, weaver ants effectively controlled the citrus stinkbug *Rhynchocoris humeralis*, leaf-feeding caterpillars *Papilio spp.*, the aphids *Toxoptera spp.* and the citrus leafminer *Phyllocnistis citrella*. The psyllid *Diaphorina citri*, vector of greening disease, was rarely observed in orchards with *O. smaragdina*, and hence incidence of this devastating disease was very low to completely absent. Due to excessive pesticide use in the intensive fruit cropping systems, the weaver ant is now rarely found except in the more extensively managed orange orchards where farmers generally spray insecticides less than four times per year.

Pesticides affect not only the larger predators like ants, ladybird beetles and spiders, but also predatory mites and parasitoids. The last group is mainly important in controlling aphids, scales, mealybugs and lepidopterous pests like the citrus leafminer. That broad-spectrum pesticides can actually increase or even induce pest problems by killing the beneficial organisms (a phenomenon called pest resurgence) has been illustrated for several pests in different cropping systems. For example, worldwide in all major citrus growing regions resurgence of mite pests in citrus orchards has been reported after frequent application of broad-spectrum organophosphates, carbamates, and, more recently, also pyrethroids. Similarly, increased problems have been reported with scales and mealybugs. The citrus leafminer, endemic in Asia, is readily kept under control in this region by naturally occurring parasitoids or lacewing predators, but only where no broad-spectrum pesticides are used.

The use of pesticides around the flowering period also directly affects pollinators, reducing fruit set and yield. A report by the Vietnamese National Bee Research Centre indicated that pesticide use is a sever problem for beekeepers, with losses being reported in about 40% of the hives.

Environmental problems

Fruit trees in the Mekong Delta are typically grown on raised beds interspersed with canals. These canals are in direct contact with smaller rivers and, together with the rice irrigation canals form a dense aquatic network throughout the region. Through the process of run-off rivers are readily polluted with pesticides and fertilisers. This poses a problem to the important economic activities of fish and shrimp cultivation, and rivers are for many people the only source of water for washing and cooking.

Farmers' knowledge of pest management

Loss of traditional knowledge

Indigenous technologies is often eroded where the importance of the cash economy becomes so great that farmers seek to maximise yield. Stimulated by advertisements of the agrochemical industry farmers tend to believe that chemical pest control is a prerequisite for improving their yield. Before the 1990s almost no pesticides or chemical fertilisers were used in orchards in Vietnam. Farmers not only conserved weaver ant colonies, but at the same time conserved many other less conspicuous natural enemies, thus keeping all pests within acceptable limits. However, with the increased use of pesticides new problems such as citrus leafminer and mites have become more prevalent, and farmers are responding by using even more pesticides as they have no idea of how to tackle these new problems. By putting their fate in the hands of the chemical companies, and with the belief that chemical pest control is modern, traditional practices are often abandoned.

None of the citrus farmers in the Red River Delta in northern Vietnam still practise weaver ant husbandry: in the Mekong Delta mainly the older citrus farmers keep up with this tradition. Farmers with weaver ants in their orchard sprayed only half the amount of pesticides compared to those without ants. However, with the problem of pest resurgence it is highly likely that they also will increase their pesticide use in the near future, finally abandoning their practice of weaver and husbandry.

Newcomer farmers have no traditional knowledge whatsoever and lack any experience in growing fruit crops in a sustainable manner. Traditional knowledge is rarely transferred to these people who often consider ant husbandry as old-fashioned.

Traditional skills enhance biological control

As traditional farming systems are prone to many external forces, of which the pesticide industry is but one, it is imperative to assess current farmers' knowledge. Because rural people often have extensive knowledge of relatively conspicuous organisms, scientists can learn much from them.The traditional use of the weaver ant as a successful biological control agent in several Southeast Asian countries therefore deserves special attention. Chinese citrus farmers already used this ant as far back as the 3rd Century AD. Likewise, in Vietnam fruit farmers have traditionally enhanced biological control in one way or another. For example, mango farmers merely tolerated weaver ant colonies, whereas the majority of citrus farmers actively cared for these ants, justifying the name of ant husbandry.

Over the years, farmers have developed several traditional weaver ant husbandry skills or techniques. These involved obtaining and establishing ant colonies, providing food and refuge for the ants, placing bridges between trees and protecting established colonies from competing ant species. It also involves avoiding pesticide use as much as possible. Apart from their role in protecting plants from pests, ants are also commonly believed to have a fertiliser effect on citrus trees. Experiments indicated that external shine and fruit juiciness were improved when ants were present, suggesting that ant wastes are nutrients for the plant.

Citrus farmers place artificial bridges to enhance weaver ants as biological control agents. Photo: Tran Van Hai.

Elevating farmers'knowledge

External support may be necessary to restore confidence and dynamism in traditional knowledge systems. This could be done by:

- **Studying and documenting farmers' traditional practices** Scientific validation by local and foreign scientists may increase farmers' pride in the use of traditional knowledge, Farmer participatory interactions could identify farmers to act as experts in future integrated pest management (IPM) training programmes. The fact that older citrus farmers still practising ant husbandry obtain similar yields while spending only half the amount on pesticides and chemical fertilisers illustrates that a lot of money is wasted on unnecessary chemical inputs. Future IPM programmes should draw on these farmers' experience in managing their agroecosystem.
- **Developing a permanent forum where farmers can exchange experiences** Because farmers practising weaver ant husbandry have no forum or platform to exchange ideas, the establishment of 'weaver ant clubs' could help make farmers better decision-makers. Social aspects need to be taken into consideration. For example, in the Mekong Delta, individualism and competition is quite strong among all fruit farmers. Methods should use farmers' attitudes towards competition in the development of IPM, rather than look on it as a constraint. Contests could be organised between groups of farmers, for instance between different villages or districts, rather than focusing on individual performance. An 'IPM village of the year award' is but one of the tools for improving extension-community interactions.
- **Incorporating traditional knowledge in participatory training and research programmes** Extension workers have often neglected traditional farmer practices. Training of newcomer, inexperienced fruit farmers, and plant protection and extension staff by experienced older farmers offer good possibilities. There is also scope to increase the knowledge of experienced farmers about the agroecosystem. Successes have already been achieved in IPM programmes in rice, vegetables and cotton. For fruit crops, participatory exercises still have to be developed for pruning, fertilisation, irrigation, pest management and post-harvest technologies, among other topics. To understand how these practices can influence the level of pest damage, farmers need training about the role and impact of all natural enemies and not only the easy-to-observe predators.
- **Strengthening farmers' knowledge base of their agroecosystem through farmer training** It can be very useful to build on farmers' knowledge through enhancing their observational skills. However, when not rooted in the context of farmers' own fields, some information can lead to higher pesticide use.

"Newcomer fruit farmers lack experience and use excessive amounts of pesticides and chemical fertilisers to boost yields."